Chapter 7

Record Linkage of Progress Towards Meeting the New Jersey High School Proficiency Testing Requirements

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Abstract

The New Jersey Department of Education has undertaken a records linkage procedure to follow the progress of New Jersey's Public school students in meeting the state standardized graduation test--the High School Proficiency Test (HSPT). The HSPT is a test of higher order thinking skills mandated by state legislation in 1988 as a graduation requirement which measures "those basic skills all students must possess to function politically, economically, and socially in a democratic society." The HSPT is first administered in the fall of the student's eleventh grade. If the student is not successful in any of the three test sections -- reading, mathematics, writing -- he/she has additional opportunities, each semester, to retake those test sections for which the requirement is still unmet. In terms of public accountability of educational achievement, it is very important to define a population clearly and then to assess the quality of public education in two ways -- the ability of the educational program to meet the challenge of the graduation test at the first opportunity (predominantly an evaluation of the curriculum); and the ability of the school system, essentially through the effectiveness of its interventions or remediations, to help the population meet the graduation requirement over the time remaining within a routine progression to graduation.

New Jersey uses a unique student identifier (not social security number) and has designed a complete mechanism for following the students through the use of test answer folders, computerized internal consistency checks, and queries to the school districts. The system has been carefully designed to protect confidentiality while tracking student progress in the many situations of moving from school to school or even in and out of the public school system, changes in grade levels and changes in educational programs (such as mainstreaming, special education, and limited English proficient programs).

Preserving confidentiality, linking completely to maintain the accuracy and completeness of the official records, definitions and analysis will be discussed.

Introduction

The New Jersey Department of Education has undertaken a record linkage procedure involving use of computers in the deterministic matching of student records to follow the progress of New Jersey's public school students in meeting the state standardized graduation test -- the High School Proficiency Test (HSPT). The HSPT is a test of higher order thinking skills mandated by state legislation in 1988 as a graduation requirement which measures "those basic skills all students must possess to function politically, economically, and socially in a democratic society." The HSPT is first administered in the fall of the students' eleventh grade. If the student is not successful in any of the three test sections -- reading, mathematics, writing -- he/she has additional opportunities, each semester, to retake test section(s) not yet

passed.

On first glance it would seem that New Jersey Department of Education's records linkage task is an easy and straightforward one. Since in October 1995, 62,336 eleventh grade students were enrolled in regular educational programs in New Jersey's public schools and 51,601 (or 82.8%) of these students met the HSPT testing requirement on their first testing opportunity (also includes eleventh grade students who may have met the requirement in one or more test sections while categorized by their local educators as "retained tenth grade" students), only 10,730 students need to be followed forward for three more semesters until graduation! Since some of these students (probably half again) will meet the requirement upon each testing opportunity, the number diminishes and the task should be trivial ... right? We have high speed computers and the public wanting this information thinks we just have to push a few buttons!

The problem is complicated, however, especially by flows of migration (students entering or leaving New Jersey's public schools) and mobility (students transferring from one public school to another), and gets increasingly more subject to error as time from the original eleventh grade enrollment passes. From the perspective of the policy maker in the Department of Education whose intent it is to produce a report of test performance rates which are comparable over schools, districts, and socio-demographic aggregations, the problem is further complicated by the fact that grade designation is a decision determined by local educators and rules may vary from school district to school district. Changes in a student's educational status with respect to Limited English Proficiency programs and/or Special Education programs also complicate tracking.

In terms of public accountability of educational achievement, it is very important to define a population clearly and then to assess the quality of public education in two ways:

- the ability of the educational program to meet the challenge of the graduation test at the first opportunity (predominantly an evaluation of the curriculum); and

- the ability of the school system, essentially through the effectiveness of its interventions or remediations, to help the population meet the graduation requirement over the time remaining within a routine progression to graduation.

Before the New Jersey Department of Education developed the cohort tracking system, information on HSPT test performance was reported specific to each test administration. This cross-sectional method of analysis was dependent on which students attended school during the test administration, and even more dependent on local determination of students' grade level attainments than in a longitudinal study. Using the cross-sectional reports, it was very difficult, if not impossible, to meaningfully interpret reports which were for predominantly retested student populations (i.e., what did the fall grade 12 test results report really mean?).

Methodology

The cohort tracking project is a joint effort involving the New Jersey Department of Education, National Computer Systems (NCS), and New Jersey educators in public high schools. The department is responsible for articulation of the purpose of the project and establishing procedures to be used -- including such activities as statistical design and decision-making rules, maintaining confidentiality of individual performance information, and assuring appropriate use and interpretation of reported information. NCS is responsible for development and support of a customized computer system, its specifications and documentation. The system is written in COBOL and provides features necessary for generation of the identifier; sorting and matching; data query regarding mismatches, nonmatches the uniqueness of the identifier, and assurances of the one-to-one correspondence of identifier to student. The department and

NCS share responsibility in maximizing the efficiency and effectiveness of the system and in trying to reduce the burden of paper work involved in record keeping. minimizing queries back to local educators, utilizing the computer effectively in checking information for internal consistency, developing and maintaining quality control procedures of interim reports to the local educators and public reports, and maximizing yield of accurate information. The local educator maintains primary responsibility related to the validity of the information by: assuring the accuracy of identifier information about individual students, reviewing reports sent to them to assure the accuracy and completeness of information about their enrolled and tested student population; and the responsibility to ascertain that every enrolled student is listed on the school's roster once and only once!

At its inception in October 1995, the cohort tracking project was intended to follow a defined population of eleventh grade students forward to their anticipated graduation (the static cohort). Local educators objected to this methodology because they could only educate students who were currently enrolled. To address this very important concern, the dynamic cohort was defined (see Figure 1). In effect, the dynamic cohort represents statistical adjustment of the original static cohort at each test administration to allow students who have left the reference group (school, district, or statewide) without meeting the graduation testing requirement to be removed from observation and adds those students who entered the reference group after fall of the eleventh grade and have not already met the testing requirement. Statistics produced for either the static cohort (prospective perspective) or the dynamic cohort (retrospective perspective) were not true rates, but rather were indices since after the first test administration (on the last day of testing in the fall of the eleventh grade) these populations are no longer groups of students served within a school, district, or state at a specific moment in time.

The mobility index -- simply the sum of the number of students entering and the number of students leaving the reference group since the last day of testing in fall of the eleventh grade, divided by the reference group at the initial time point -- was designed to help the user interested in evaluating educational progress as assessed by the HSPT (educator, parent, student, citizen and/or policy maker) decide which set of statistics, static or dynamic, would be more appropriate with respect to a particular reference group (school, district, or state). The higher the mobility level, the greater the difference between the set of statistics, and the more likely reliance should be made of the dynamic statistics.

In developing the system, the department had a need for a cost-effective, accurate, and timely system. The department needed exact matches and, therefore, could not rely on probability matching or phonetic schemes such as NYSIIS. A system with a number of opportunities for the local educator to review and correct the information was developed. A mismatch (or Type II error) was considered to have far more serious consequences in this tracking application than a nonmatch (or Type I error) because an educator might be notified that a student met requirements in one or more testing sections when that has not yet occurred (and the student might have been denied an opportunity to participate in a test administration based on a mismatch). The nonmatch is especially of concern to the local educator, because the most likely scenario here is that the student is listed in the file more than once, and none of these (usually incomplete) student records are likely to show all of the student's successes, therefore, the student was in the denominator population multiple times and had little or no chance of entering the numerator of successful students. In working with various lists and HSPT ID discrepancy reports, local educators have had heightened awarenesses of the "Quality in ... Quality out" rule mentioned by Martha Fair (Fair and Whitridge, 1997).

Figure 1. -- Definitions of Static and Dynamic Cohort

	Static Cohort	Dynamic Adjusted Cohort (after each admin)
	Enrollment Fall Junior / (*N*)	Adjusted after Each Administration
State Level	No Adjustments $\frac{\Sigma_{n_{p_i}}}{N}$	$\frac{\Sigma_{n_{p_i}}}{N+\Sigma_{y_{1_i}}-\Sigma_{y_{4_i}}}$
District Level:	No Adjustments $\frac{\Sigma_{n_{p_i}}}{N}$	$\frac{\Sigma_{n_{p_i}}}{N+\Sigma_{y_{2_i}}-\Sigma_{y_{6_i}}+\Sigma_{y_{1_i}}-\Sigma_{y_{4_i}}}$
School Level:	No Adjustments $\frac{\Sigma_{n_{p_i}}}{N}$	$\frac{\Sigma_{n_{p_i}}}{N+\Sigma_{y_{1_i}}-\Sigma_{y_{4_i}}+\Sigma_{y_{2_i}}-\Sigma_{y_{5_i}}+\Sigma_{y_{3_i}}-\Sigma_{y_{6_i}}}$

N = fall enrollment

y = in and out

n_{p_i} = # pass

pass

i = test administration, where
1 = 1st test administration for cohort
2 = 2nd test administration for cohort

Varies by administration (i)

y_{1_i} = in from out of state or private school

y_{2_i} = in from within state(public school), out of district

y_{3_i} = in from within state (public school), within district

y_{4_i} = migrate out of state public schools

y_{5_i} = migrate out of school, in district

y_{6_i} = migrate out of district, out of school, within state public schools

(out of state means out of N.J. Public schools)

Y's are only for those who have yet to pass test

Statistical notation developed by Gerald E. DeMauro, Director, Bureau of Assessment, NJDOE

Considerations Regarding the Identifier

This records linkage application is a relational database dependent on a unique identifier -- the HSPT identification number (HSPT ID) -- and supported by the following secondary fields: name (last and first but not middle initial), date of birth, and gender. In determining a unique identifier, the department first considered the use of social security number because it is a number which has meaning to the individual (is known), and is nearly universal and readily available to the individual. However, the department abandoned the plan to use SSN before the tracking project was implemented because citizens complained -- both verbally and in writing. Concerns included not wanting to draw attention to illegal aliens and considerations of the reasonableness of the number in terms of an individual's willingness to disclose it to school officials for this purpose and how use of the SSN may make it possible to access other unrelated files.

In reviewing Fair's criteria for a personal identifier (permanence, universality, reasonableness with respect to lack of objection to its disclosure, economy, simplicity, availability, having knowledge or meaning to the individual, accuracy, and uniqueness), the HSPT ID received low marks related to permanence and having the property of being easily known or meaningful to the student. The HSPT ID rated high marks on universality and reasonableness, with respect to lack of objection to its disclosure, precisely because it lacked meaning and could not be easily related to other records. The HSPT ID is also economical, simple, accurate, and is secured and safeguarded -- procedures have been implemented which assure that only appropriate school officials can access specific HSPT IDs for their enrolled populations and next access confidential information associated with these students' records of test results, in accordance with concerns regarding data confidentiality (U.S. Department of Education, 1994). Work involving assurance that there is only one number per student includes an HSPT ID update report, an HSPT ID discrepancy report, and multiple opportunities for record changes to correct information on student identifiers based on local educators' reviews of rosters (lists) of their students' test results.

The HSPT ID has been generated within the tracking system on the answer folder for each first-time test taker. Repeat test takers were to use stickers with student identifiers contained in a computer bar code label provided by NCS. District test coordinators can also contact staff at NCS, and after reasonable security checks are completed, obtain the HSPT ID and test results (from previous test administrations) for entering students who have already been tested.

A cohort year designation is to be assigned to a student once and only once. Safeguards are currently being developed to assure that despite grade changes over time, each student is followed based upon the initial (and only) cohort year designation.

Validity Assurances

The department and NCS are currently developing additional computerized procedures to assure the one-to-one correspondence of the HSPT ID to the student. A critical element in the assurance of the validity of the correct identification of each enrolled student as well as pass/fail indicators (for each test section and the total test requirement) is the review of the static roster immediately following the fall eleventh grade test administration.

Recently also, safeguards have been added to the computer system to assure:

- that for a given HSPT ID once a passing score in a particular test section has been obtained by a student, no further information on testing in that test section can be accepted by the cohort tracking system because the first passing score is the official passing score; and

- that for a student who has met the testing requirement by passing all test sections the HSPT ID

number is locked and the system accepts no new information to be associated with that HSPT ID.

Quality Control Procedures for Cohort Reports

Quality control of cohorts reports is a joint effort on the part of the department and NCS. Quality control procedures include visual review of student rosters and statistical report, utilization of a system of SAS programs generated under the same project definitions and decision-making rules by a different programmer in order to check the logic used in the COBOL programs. To date, this quality control has been conducted three times. There is a written quality control protocol which has made it possible to move from the implicit understanding of records linkage methodology and computer systems capabilities to explicit criteria for this particular application. These explicit criteria are identified, clearly articulated, and observable. This protocol has been very useful in that it :

- helped clarify expectations for NCS,
- allowed more department staff to participate fully in the quality control process while minimizing need for specific project orientation or training time, and
- more complete documentation of the quality control effort for each cohort after each test administration. Refinement of these quality control procedures is on-going.

Confidentiality

In addition to the procedures for release of HSPT ID described above, confidentiality is preserved on cohort dynamic out rosters in that students who have left a school are listed without pass/fail indicators for test sections and the total testing requirement.

With respect to public reporting, the department has been very conservative in using a rule of "10" instead of the rule of "three"; in this way individual student test performance information is not discernable from information reported publicly.

Results

Actual test performance results based on this longitudinal study have been reported only once to date (Klagholz, L. et al., 1996). These results were for the first cohort, juniors in October 1995, and followed students through one academic year (two test administrations). The audience of public users seemed to receive the information well and are currently anticipating the December 1997 release of information which is to include the academic progress of the 1995 cohort toward graduation and, in comparison to last year's public release, the academic progress of the second cohort, juniors in October 1996, through their junior year.

While there are a variety of ways to correct and update the cohort tracking master data base, a key (and predominant) method is the first record change process after receiving initial test results. The record change process is an opportunity for correction of erroneous data related to permanent student identifiers (name, date of birth, and gender), personal status identifiers (school enrollment, grade, participation in special programs (such as Special Education, Limited English Proficiency programs, and Title I), and test related information (attendance at time of testing each content area, void classifications, and first time or retest taking statuses).

There were a total of 2,526 record changes processed at this first opportunity for data review. This is not an unduplicated students count, since one student's records might have needed several variables to be

corrected. It is not readily obvious what denominator to suggest in determining rates -- 93,627 for total students enrolled (including students in special programs) would be most appropriate in determining a proportion of the total population to be tested for a cohort year. Another approach, however, would be that record changes as they relate to the cohort tracking project, should be segmented and the number of record changes for the students who had one or more test sections yet to pass after the October test administration would be useful; however, that statistic is not readily available.

Numbers of record changes by reason were as follows:

Student identifiers:	name:	447
	date of birth:	218
	gender:	41
	school:	53
Status:	grade:	367
	Special Education:	631
	Limited English Proficiency:	196
	Title I:	153
Test specific information:	attendance on test days:	43
	void classifications:	57
	first time or retest status	381 .

A systematic error regarding 731 students who were tested for the first time in April 1996 occurred. These students were not appropriately reflected in the dynamic cohort statistics. The computer system has been corrected to handle these cases correctly. This also necessitated tightening the quality control protocol and procedures. Corrected test performance rates for that same time point in the longitudinal study will be released in December 1997. While no one ever wants to release erroneous information, it was interesting to note the order of magnitude: for 51 schools there was no change, for 44 schools the correction increased pass rates by up to 0.8%, and for 136 schools passed rates decreased (by within 1.0% for 104 schools and between 1.1% and 4.2% for 32 schools).

The mobility index was designed to measure the stress on student populations caused by students who change the educational climate by either entering or leaving a particular high school after October of their junior year. This index was considered to be needed to guide the decision as to whether the set of static or dynamic statistics would be more appropriate measures of progress for a given reference group (school, district, state). The mobility index was observed to have a highly negative correlation with test performance. This finding was especially important to educators in communities with high mobility in that it helped these educators quantify the seriousness of the socio-economic problem, and communicate it in understandable terms regarding the consequences of these moves upon the continuity of students' educational experiences and educational progress in meeting performance standards.

Plans for the Future

The department has an ambitious plan to increase the graduation test (and assessments at fourth and eighth grades) to include eight test sections (content areas). The cohort tracking project is to be expanded to include all test sections on the graduation test. Cohort tracking is also to be extended vertically to the other grades for which there is a statewide assessment program.

The possibility of developing a population register for students enrolled in New Jersey's public schools is under discussion. Then the cohort tracking system would be incorporated into a larger department information system for reviewing educational programs, attendance, and school funding as well as outcome measures such as test results. In discussions about a population registry, social security number has been proposed for the linkage variable.

References

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